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Harnessing the Power of Big Data for Medical Informatics

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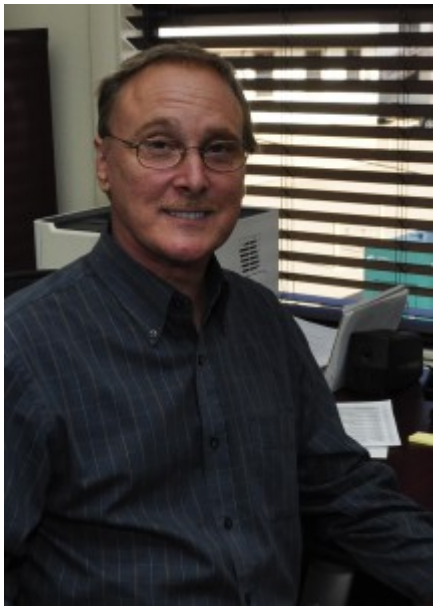


Michael Galarneau, director of operational readiness at Naval Health Research Center

“Big data” is a popular buzz phrase these days—a term used to describe large volumes of data that can be mined and analyzed for information and insights. The term “big data” may be new, but the concept isn’t, and at the Naval Health Research Center (NHRC), we’ve being doing a lot with big data for over 35 years.

In 1980, Milan Miller, a researcher at NHRC, created a unique data resource to support epidemiological and longitudinal studies of health and performance in military personnel. That database, which has grown over time, is called the Career History and Archival Medical and Personnel System (CHAMPS) and contains personnel and medical data for millions of individuals who served on active duty in the United States Navy, Marine Corps, Army, Air Force, and Coast Guard.

As of December 2014, CHAMPS contains data for over 10 million service members from the date they entered the military until their discharge from active duty. CHAMPS has proven to be a valuable resource for research focusing on medical management, occupational health, preventive medicine, and epidemiology across the Department of Defense (DoD).

But CHAMPS was just the beginning. From that first foray into big data, our researchers have been continually expanding and innovating our data capabilities to support the health and readiness of our warfighters.

Today, NHRC has a team of scientists and researchers who collect, analyze, and interpret health and medical data. With the databases and software applications developed at NHRC serving as the cornerstone, our medical informatics capabilities include data management, medical planning, casualty estimation, casualty care and operational risk assessment, and medical intelligence for expeditionary medical planning and logistics. In other words, no matter where the mission may take our military, NHRC can provide senior leaders and medical staff with accurate and reliable information to ensure they are ready to provide the right care and treatment for our warfighters at the right time and in the right place.

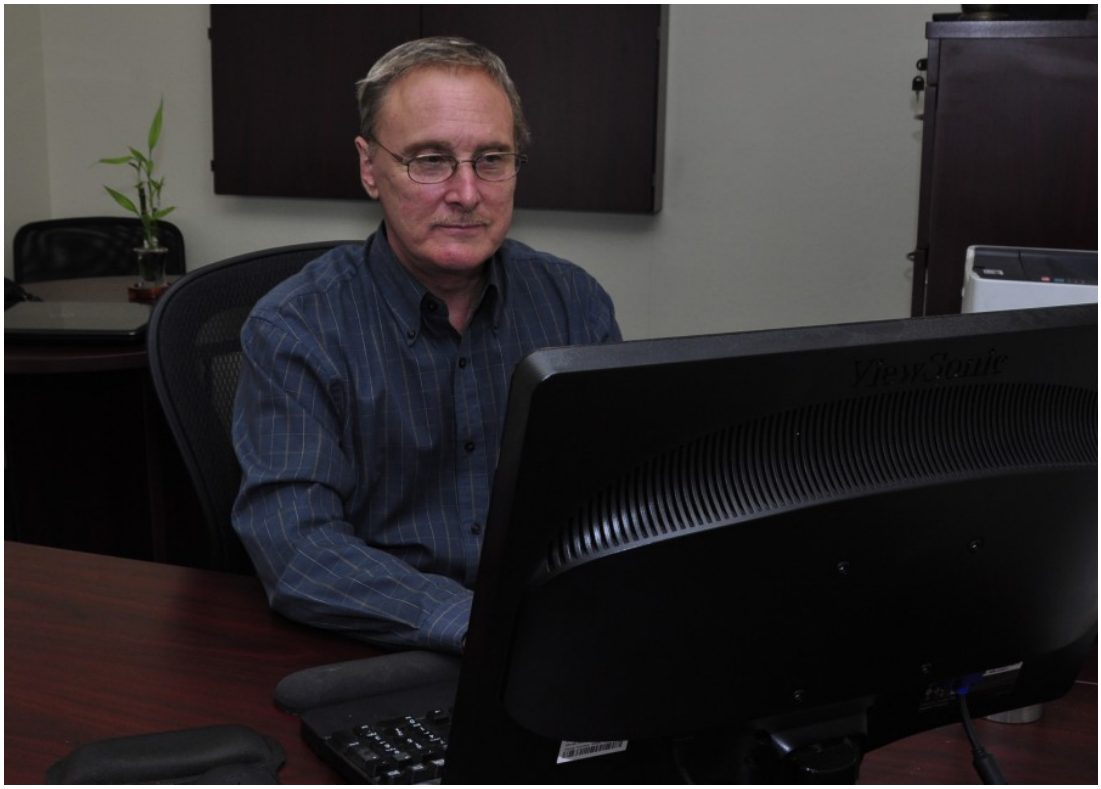
In addition to CHAMPS, NHRC staff developed the Expeditionary Medical Encounter Database (EMED) to improve medical mission readiness. EMED provides military health researchers and medical planners with accurate injury and clinical treatment data for casualties from point of injury to definitive care and rehabilitation. As Navy and DoD requirements have evolved, the EMED has transformed into a high-quality data repository that supports studies on multiple topics, including:

- Injury prevention and mitigation

- Patient stream estimates
- Personal protective equipment evaluation
- Quality of life outcomes
- Clinical practice guidelines
- Determination of theater medical requirements

But there's more to big data than just bytes and bits floating around in the ether. Data mining—building models and algorithms that find patterns or relationships in data—is an indispensable component of big data and allows researchers to harness those bits and bytes and shape them into meaningful insights. Essentially, it's what you do with your data that counts and NHRC has been leading the way in data mining and leveraging partnerships and collaborations to improve the health and readiness of our warfighters.

Putting Big Data to Work



The Joint Trauma Analysis and Prevention of Injury in Combat (JTAPIC), a DoD program and virtual partnership of 11 different organizations including NHRC, is supported by EMED. Using information from the database, researchers from NHRC's Medical Modeling Simulation and Mission Support Department can provide a comprehensive analysis of combat-related events that cause injuries in service members. The analyses from NHRC and other JTAPIC partners provide leaders with vital information about specific scenarios to inform decision-making that can save lives, prevent or mitigates injuries, or save money. One of JTAPIC's accomplishments includes substantial improvements to armored vehicles, resulting in many of our warfighters avoiding death or injury.

In keeping with our history of developing innovative solutions to support readiness, NHRC researchers have created modeling and simulation tools that leverage our databases to allow medical planners and logisticians to prepare for different operational scenarios, whether on land or sea or in support of combat or disaster relief operations. The Joint Medical Planning Tool (JMPT) and the Medical Planners' Toolkit (MPTk) each pull data from EMED and are fully accredited for DoD use.

The MPTk is a suite of tools that can predict the likelihood of injuries and illnesses given a variety of possible scenarios. Medical planners can use MPTk to estimate casualties across a range of military operations, from combat to humanitarian missions, to help determine what supplies, equipment, and personnel are needed to

manage casualties and ensure lifesaving medical care is available.

The JMPT, a computer-based simulation tool fully integrated with the MPTk, helps evaluate medical mission support by modeling patient flow from point of injury to definitive care. The JMPT is used to support research, medical systems analysis, operational risk assessment, and field medical services planning. Using the JMPT, military and medical leaders can determine what type of military treatment facilities (battalion aid station, fleet hospital) will meet the needs of a specific patient stream, how relocating that facility will impact treatment, and how best to use personnel and transportation assets to manage the patient flow for the best possible health outcomes. Together, the JMPT and MPTk are powerful data analytics tools enabling DoD personnel to provide mission-appropriate medical support that will save lives and mitigate injuries and illnesses.

As a research center, it is in our DNA to innovate, collaborate, and look for new ways of pushing the boundaries of what is possible. From creating databases to developing tools for data mining and analyses, NHRC will continue to be on the leading-edge of big data and expand our medical informatics capabilities to optimize the health and readiness of our 21st century warfighters.

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